Orchid Culture

Oncidium

Cattleya

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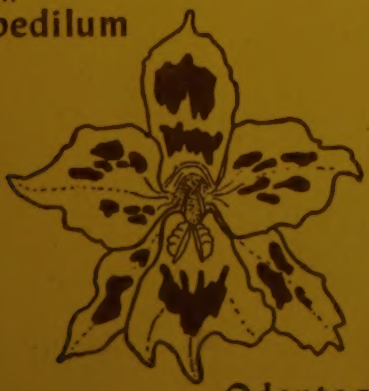
CULTURE

Paphiopedilum

Phalaenopsis



Odontoglossum

Missouri Botanical Garden Bulletin
Volume XLVII February, 1959 Number 1

NOTICE

SPECIAL COURSE OFFERED TO FRIENDS OF THE GARDEN

A course in Spring Flowers, open only to Friends of the Garden and without charge, will be given on four Thursday evenings, April 16, 23, 30 and May 7, from 8 to 9:30 p. m., in the Museum Building, 221 Tower Grove Avenue (opposite Cleveland Avenue). This course will be conducted by Dr. Edgar Anderson, Curator of Useful Plants at the Garden. Enrollment is restricted to thirty-five. Register by writing the Garden or by telephoning PRospect 6-5567 any weekday.

COVER: Orchid drawings by Kenneth Peck.

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ORCHID CULTURE

ROBERT J. GILLESPIE

INTRODUCTION

THE Orchid family is the largest family of flowering plants. It has been estimated that of the world's flowering plants adapted to culture, in terms of total numbers, one in seven is an orchid. The orchid family (the Orchidaceae, *Orchid-ay'-see-e*), consisting of 15,000 to 20,000 species, is an extremely successful and prominent plant group found in every climate and type of habitat except the very driest deserts and the polar regions. Orchids are particularly abundant in the tropics, with two main geographical centers of distribution in Central and South America and in Southeast Asia.

Perhaps the most fascinating feature of the Orchid family is the tremendous variation which its members display in both their vegetative and floral structures. Even with such extreme variations, botanists recognize the orchid family as an excellent "natural" plant group. All of these plants have in common certain basic characteristics which indicate that they are orchids. These characteristics can be summarized briefly as follows:

Perennial herbs with tuberous or fibrous roots; stems without annual rings; minute embryo with one cotyledon; leaves with parallel veination; flowers with three sepals and three alternating petals one of which is modified into a lip; floral sexual organs united into a single structure called a column; pollen often united into waxy spherical masses called pollinia; ovary one-chambered with 3 carpels, inferior, with abundant minute ovules.

While orchids have been cultivated in the Orient for centuries, it was not until 1731 that Europe's first tropical orchid, *Bletia purpurea,* arrived in England from the Caribbean region. The first Asian orchids came to England from China in 1778. They were *Phaius Tankervillii* and *Cymbidium ensifolium.* By 1800, Kew Gardens had the largest collection of epiphytic orchids in Europe consisting of about 20 species, with Oncidium, Epidendrum and Lycaste well represented genera.

Early attempts to cultivate epiphytic orchids in Europe were extremely primitive and most plants were able to survive for only a limited time. Horticulturists lacked even the basic concepts of Orchid culture and they attempted to grow these supposed "tropical parasites" in an environment which corresponded to their ideas of a tropical habitat. First of all, orchids were always kept in very hot green-

houses into which little or no fresh air was ever admitted. The atmosphere was constantly saturated and the plants were usually kept extremely wet. Because orchids were considered parasitic, they were potted in a variety of media such as decaying and moldy wood, rotting vegetation or just plain garden soil. Despite the brutal treatment received, some plants were able to survive for rather lengthy periods of time.

The 19th century saw a veritable "Orchid Craze" overrun England, much as the "Tulip Mania" had swept Holland in the 17th Century. Every large estate had its orchid collection and English aristocrats sought, and paid tremendous prices for, rare or unusual orchids. Collectors representing both private and commercial establishments invaded the tropics to collect and export millions of orchids, most of which succumbed after a few years, to be replaced by vigorous, freshly-imported stock.

In 1835, a significant year in the history of orchid culture, Joseph Paxton, gardener for the Duke of Devonshire, stated his directions for growing orchids, thus laying the foundations for modern orchid culture. Paxton actually investigated and recorded facts about the climates where various commonly-cultivated orchids were collected. He then attempted to duplicate these conditions in his greenhouses. His success was instantaneous and his plants flourished to the degree that most English orchid growers very quickly adopted his methods. The cultural recommendations of Joseph Paxton can be summarized as follows:

1. Orchids from different altitudes should be grown at different temperatures.
2. Fresh air should be admitted into the greenhouses and the atmosphere should be kept only moderately moist.
3. A well-aërated potting medium as well as a well-drained container should be used.

Gradually through the years, Paxton's cultural principles have grown until now, horticulturists know most of the basic cultural requirements for all of the major cultivated orchid groups. The orchid grower today has over a century of knowledge and hard-earned experience to draw upon.

THE MAJOR CULTIVATED ORCHID GROUPS

The cultivated orchids encompass such a tremendous number of species indigenous to a variety of habitats that to discuss them all here would obviously be impracticable. Therefore, this treatise will include only the six major cultivated groups: The Cattleya group, the Cypripedium group, the Cymbidium group, the Odontoglossum group, the Dendrobium group and the Vanda group.

The reader should bear in mind that while discussing the details of culture of these groups, it is not possible to set forth precise formulae which, if adhered to faithfully, will insure success.

The maintenance from day to day of optimum conditions around any orchid is to a large degree a problem which must be worked out by each individual grower in his own growing area. The broad general cultural details can be presented, but each grower, to have a well-grown collection, must find the proper combination of the many minute environmental factors. Also, it must be realized that it is impossible for man to duplicate precisely the native environment of any orchid plant. For example, we cannot hope to give an orchid the same day-length pattern which exists in the tropics. Our temperatures may be too hot in the summer and too cold in the winter. Because the plant is growing in a pot, the watering schedule must be different from nature's watering pattern. Thus it becomes necessary for man to work out a set of environmental conditions which, though different from those of the plant's natural habitat, will, never-the-less, provide the requirements for best growth and development. Man can frequently control the environment of a plant to a degree that permits near-maximum growth under more ideal conditions than in nature where the plant is subjected to rapid and whimsical environmental changes. Consequently, many orchid growers have found, much to their surprise, that some orchid plants grow and flower more luxuriantly under cultivation than they do in their native habitats.

THE CATTLEYAS AND THEIR ALLIES

Cattleyas are the most popular of all the orchids and they are the principal flowers of the orchid cut-flower industry. Over 60 per cent of the orchid plants in cultivation are Cattleya species or hybrids. The genus is native to Central and South America where populations are found growing at altitudes of 3000 to 6000 feet. Here the temperatures range from 60° F. at night to about 75° during the day. The relative humidity varies from 50 per cent to the saturation point. Precipitation occurs almost daily, temporarily drenching the plants; but the water drains off quickly leaving the plants' root systems relatively dry. The light is usually rather intense and the plants are shaded by only a few leaves and branches. The cultivation of Cattleyas requires slight modifications of this natural environment.

TEMPERATURE

Orchids are classified into three groups according to their temperature requirements:

1. The warm orchids, such as the genus Phalaenopsis, which are found in low, hot, regions of the tropics and which require day temperatures of 75° and above, and night temperatures ranging from 65° to 70°.
2. The intermediate orchids, to which the Cattleyas belong, which grow best at day temperatures of 70° and above, and night temperatures of 60° to 65°.

3. The cool orchids—plants, such as the Odontoglossums, that are native to the high mountain areas where cool days and chilly nights are the rule—which prefer day temperatures from 60° to 70° and night temperatures of 45° to 50°.

Plants from the first two groups are best subjects for home culture and for growing in areas where the summer temperatures are extremely hot.

Cooling techniques: In the greenhouse, Cattleyas are usually grown at temperatures of about 60° at night and from 70° to 85° during the day. In the summer these temperatures cannot, of course, be maintained, especially in the greenhouse where during the day the temperature may soar to 100° or over. During such hot spells, periodic dampening down of walks and the gravel beds or benches between the pots, as well as lightly spraying the plants themselves will help to minimize the harmful effects of high temperatures. Such recent innovations as evaporative coolers and fog-mist devices help tremendously in keeping down summer temperatures in the greenhouse. They can frequently keep a greenhouse 15 to 20 degrees cooler than the outside temperature.

Importance of Lower Night Temperatures: While day temperatures can vary considerably with little harmful effect, the maintenance of optimum night temperatures is extremely important. This is true, not only for Cattleyas, but also for most cultivated orchids. For example, some orchids will grow well and initiate flower buds at a night temperature of 55°. These same plants will grow poorly and will not initiate flowers if kept at 60° at night.

Preventing Sudden Temperature Changes: It is not only important to maintain the proper day and night temperature in the home or greenhouse; but it is also important to avoid rapid temperature fluctuations. On a cold winter morning, for example, the sun can suddenly raise the temperature in a greenhouse from the cool night temperature to a warm day temperature in a few minutes. The smaller the greenhouse, the more quickly it is heated by the sun, for its glass surface area is very large in relation to its volume. Rapid temperature rises around an orchid plant mean that the plant's leaves become warm and physiologically active while the root system, in its solid rooting medium, is still very cold and consequently physiologically dormant. The active leaves are demanding large quantities of water and nutrients which the root system cannot possibly supply. Under these conditions, photosynthesis, transpiration and other vital plant processes are severely restricted, as a result developing flower buds and new growths can be damaged. Rapid rises in temperature on sunny days can be avoided by gradually opening ventilators early in the morning, thus permitting the greenhouse to warm up slowly. Watering the plants with warm water will help to raise the root temperature.

LIGHT

How much light intensity does a mature Cattleya require? That, unfortunately, is a relative question. A

mature Cattleya in good condition and free of disease should grow well if it receives about 3000 foot-candles (F.C.) of light. Some growers prefer to use up to 5000 F.C.; however, a Cattleya must be in very good condition to withstand such high intensities since leaf burning or the bleaching of chloroplasts can easily occur. It is doubtful, therefore, if any real benefits can be derived from extremely high light intensities.

The best criterion for judging optimum light intensities for a plant is the condition of the plant itself. A Cattleya with lush dark green leaves and soft succulent growths is not receiving enough light. Extreme yellowing and bleaching or burning of the leaves indicates too intense light. A well-grown plant receiving optimum light should have leaves with a slightly yellow cast and a hard leathery texture. A heavy concentration of red or purple pigments (anthocyanin) in the pseudobulbs or leaves, as well as slight anthocyanin speckling on the flower sheaths of some Cattleyas indicates good light conditions.

Controlling Light: Greenhouses require some form of shading from March through October with the heaviest protection needed during July and August when 30 per cent of outdoor light intensity is admitted. Clear glass is preferable from November through February. White shading compound, sprayed or painted on the glass, is a very satisfactory form of shading although some orchid growers prefer lath shades or plastic shading cloth.

HUMIDITY

Water in the gaseous state, is an important factor in any orchid's environment. Most orchids prefer a relative humidity between 50 and 80 per cent of saturation. An extremely humid atmosphere that is not moving is particularly undesirable. It is important for every orchid grower to remember that relative humidity usually varies inversely with the temperature. This means that on an average summer day in the Midwest, the morning temperature may be 70° and the relative humidity can be 100 per cent or at the saturation point. By early in the afternoon the temperature may be 90° but the relative humidity may have fallen to 40 per cent of saturation. As the temperature falls in the evening the relative humidity once again increases. Therefore, on sunny days it is usually necessary to increase the humidity in the greenhouse by dampening down floors and benches and lightly spraying the plants. This should be done before noon so as to prevent excessive plant transpiration which would occur if the humidity were drastically decreased, and also to allow the greenhouse to dry before evening thus preventing excessive condensation. Artificial heat in a greenhouse has a drying effect and the orchid grower must always be on guard against an arid atmosphere during the heating season.

WATERING

How wet is wet and how dry is dry? This is the question which continually haunts the novice orchid grower. Unfortunately, there is no unit of measure like the degree or the foot

candle which can be used as a precise indicator in watering. No set rule on watering frequency can be given. However, as a general rule of thumb, a Cattleya should be "pot-watered" when the medium in which it is growing is approaching the state of being completely dry. The plant should never become completely dry; on the other hand, it should not be watered if the root system is fairly moist. When "pot-watering," the potting medium should be thoroughly saturated; but the excess water should drain away quickly. Watering twice a week would be about average for most mature Cattleyas under normal greenhouse conditions. During the warm summer period, more frequent pot-waterings are required, while during the dull winter months a more restricted schedule should be followed. Extremely cold water should not be used and water containing high amounts of salts or which is excessively alkaline or acid should be avoided. Above all, it is important to remember that in nature the Cattleya is watered by a system which alternately soaks and dries the plant.

VENTILATION

Outside air is essential for all green plants, since it supplies them with much-needed carbon dioxide. Also, a constantly moving, light buoyant atmosphere keeps orchids vigorous and healthy. Damp stagnant greenhouse conditions encourage molds and bacterial and insect diseases. Orchid pots should be staged on open decking or on wire screening so as to allow air movement below and around the pots. Many growers are now using greenhouse fans which are kept running day and night, constantly moving the air throughout the greenhouse and thus preventing a musty atmosphere. Evaporative coolers are excellent aëration devices during the summer months for they not only lower greenhouse temperatures but they also move large quantities of fresh air through the greenhouse without creating drafts.

Greenhouse ventilators should be opened whenever possible. This may mean only "cracking" the vents for an hour on a cold, dull winter day or it may mean leaving them open for rather long periods of time during the warm summer months. Drafts should be avoided at all times and ventilators should always be opened away from the direction of the wind. This is particularly important during the winter months.

POTTING

Successful orchid growers constantly analyze their growing procedures in order to find weak links where optimum conditions are not being maintained. Potting practices are frequently the weakest link in the orchid grower's chain. In only a few minutes an improper job of potting can undo months, even years of good culture. It is imperative, therefore, that every grower understand exactly how and when orchids should be repotted. Unfortunately, potting is as much an art as it is a science and while the technique can be studied through the literature and in illustrations, it still cannot be mastered without actual practice. If possible, every novice

orchid grower should receive at least one potting lesson from an experienced potter. He would benefit more from such a lesson than he could from studying numerous articles or illustrations.

When to Pot

Regardless of the size of growth or of the flowering pattern exhibited by any plant, the best time to repot a Cattleya is just at the time when its new vegetative growths are sending out a flush of roots. The new growth on one particular plant may be only an inch or two long when it "roots out," another plant may be in full flower and initiating roots at the same time. Potting almost always injures the existing root system of a plant. If the plant is not at a point in its growth cycle where it can quickly replace its lost roots with new vigorous ones, severe dessication and even death can result. If a plant is passed by and not repotted at the proper time, it is usually best to refrain from potting until the plant develops another growth and sends forth new roots. A Cattleya is in need of repotting when its new growths are extending beyond the pot or when the potting medium has broken down to the point where optimum growth is no longer possible. On the average, a Cattleya will need repotting once every 18 months to two years.

How to Pot

Potting procedures can be divided into three broad categories: a. preparation of potting materials, b. potting technique, and c. post-potting care.

Preparation of Potting Materials: Two basic types of potting media are now available to the orchid grower. Each of these materials is quite satisfactory; in most cases both produce about equal results. Osmunda fiber (the roots of the Osmunda fern, *Osmunda regalis*) has been in use for over 50 years. It contains all of the nutrients needed by epiphytic orchids; but it is expensive to buy and difficult to work with, requiring considerable practice for mastery of its use. Fir bark has been in general use for about five years and has almost completely replaced Osmunda fiber as a potting medium for epiphytic orchids. It is the bark from any of several species of western conifers, principally *Abies concolor*, the White Fir. While fir bark is nutritionally quite poor, it is, never-the-less, easy to use, relatively inexpensive, and seems to stimulate root development in some orchid species.

The following discussion of potting will be based on the use of fir bark. Those who are interested in using Osmunda fiber for potting will find in the appendix a list of references, some of which have well-written sections on its use.

For potting Cattleyas, the following materials are required:

Pots, pieces of broken pot (crock), fir bark, scissors, pruning shears, key-hole saw, wire stakes, string and celluloid orchid labels.

Fir bark should always be potted moist. Extremely dry bark loses its hygroscopic water and resists moistening so that a plant potted in dry bark can become dessicated even though it

E. L. EVINGER

An orchid grower's potting bench with fir bark and other potting materials.

E. L. EVINGER

A hybrid Cattleya plant in need of repotting. Note new roots.

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Cattleya plant removed from pot showing the root system in fir bark.

E. L. EVINGER

Root ball being divided with key-hole saw after rhizome was cut with pruning shears.

E. L. EVINGER

Newly separated division being potted in fir bark. Note that plant is being held with the youngest part in the center of the pot.

E. L. EVINGER

On the left the newly potted division and on the right the remainder of the plant which was returned relatively undisturbed to the pot.

is watered properly. Freshly potted fir bark can be easily washed out of pots and it is necessary to use a water breaker or bubbler on the hose or watering pot to break the force of the water. It is important to use only the screened coarse grade of fir bark for potting mature Cattleyas. Finer particles tend to pack and drain poorly, thus preventing good root development.

Nutrients can be added to fir bark at the time of potting. If one standard 3-in. flower pot full of each of the following nutrients—super-phosphate, bone meal, hoof and horn meal, and a 10-10-10 water soluble chemical fertilizer—is mixed into a standard 3-cu. ft. bag of fir bark, it will supply the plants being potted in the material with enough food for a year and no supplemental feedings will be required.

Pots to be used should be clean and have no cracks. Three-quarter (azalea) pots are the type usually preferred but standard clay pots are adequate. The holes in the bottoms of the pots can be enlarged with a hammer to aid in drainage and to improve aëration.

Potting Technique: When repotting an orchid, the grower has an ideal opportunity to clean the plant, removing the dry sheaths covering the pseudobulbs and removing any scale insects (see Orchid diseases, Insect pests) by scrubbing infested areas with an aqueous solution of DDT. An old tooth brush works fine for this scale removing process. After cleaning the plant, the strings attaching it to the supporting wire stake should be cut and the stake removed.

The plant can be easily removed from the pot by inserting a pair of

scissors half way down between the pot and the root ball. Then by prying up with the scissors the plant can be popped out of the pot with the root system intact.

If the plant is too large to be inserted into an easily handled pot, it should be divided. Each separated division should have at least three mature pseudobulbs with leaves for every lead (growing tip). This will insure that every division will have the leaf surface area needed to produce enough food for normal growth and development. The rhizome should be cut using a pair of sharp pruning shears at the selected point between two pseudobulbs. The rest of the root ball can then be cut through with a keyhole saw.

The next step in potting is to select the proper pot for each separated division. It is essential to use a pot which is not so large that the roots and medium are constantly wet nor so small that the contents are always dry. Most growers select a pot that will allow the inserted plant enough room to make two or three successive growths. The plant should always be potted so as to allow maximum room for future growth. This means that the oldest part of the plant should be butted against the pot in such a way as to allow the lead bulb to sit in the middle of the pot.

The pot selected should be filled to one-fourth full with crock. Then the division should be held in one hand, with the rhizome horizontal and about one-half inch below the rim of the pot; while, with the other hand, the fir bark should be filled in below and around the plant until it reaches the level of the rhizome. After this, the bark can be pressed down slightly with the thumbs, and a little more added to bring it to the top of the rhizome.

Insert the wire stake, taking care not to injure any dormant "eyes" located at the base of the pseudobulbs. Each bulb can then be tied to the wire stake in such a way that one leaf does not shade or hide another. After attaching the label indicating the date of repotting to the plant, it is ready to be returned to the growing area.

Post-potting Care: A newly potted orchid must receive special treatment until it recovers from the shock of repotting. This means the plant should be placed under slightly reduced light and watered sparingly until the roots are near normal. It should never be over-watered, for without an established root system to absorb excess moisture, the pot can remain saturated for an indefinite period and the newly developing roots will be smothered and will die. Newly potted plants should never be placed in a cold damp environment with little or no moving air, for these conditions are detrimental to root development.

If the fir bark is used without added nutrients, it is necessary to feed the plants monthly with a standard water-soluble chemical fertilizer at the strength recommended for house plants.

GROWING CATTLEYAS IN THE HOME

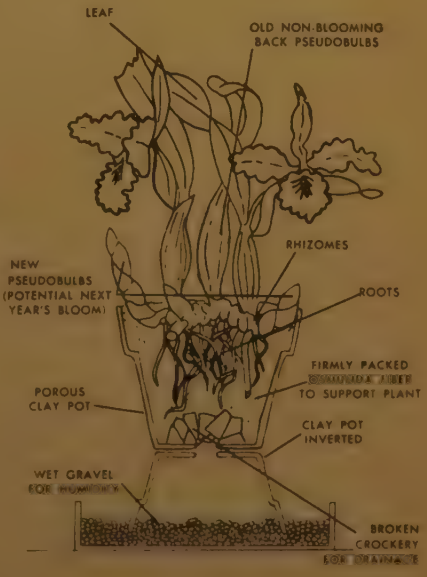
Cattleyas can be grown in the home. Every day home orchid enthusiasts are proving that this is true and that the experts who say it can't be done are wrong. It should be stated in the beginning that home orchid growers have brought out a fact which was not thoroughly understood prior to the home culture endeavor; and that is, that most orchid plants will grow and flower in an environment where one factor is not optimum. However, if two or more environmental factors are not optimum, the plant has difficulty surviving. This is important for the home culturist to know for he is growing his plants in a borderline habitat where the critical environmental factors must be carefully regulated. Analyzing the conditions in the average home, it becomes quickly apparent that the following factors are not optimum:

Humidity. The normal home has a relative humidity below the desired optimum for Cattleyas.

Light. Home conditions usually have too low light intensity.

Temperature. Most home night temperatures are above those required by Cattleyas.

Home orchid growers have overcome the above limitations in the following ways. Place plants in a bright sunny window with at least 6 hours of direct sun exposure a day. Some shading may be necessary in the spring and fall. The plants should be placed over (NOT IN, see diagram) a pan or tray containing gravel that is kept wet which helps to maintain a slightly higher humidity in the area of the plants. The plants can be sprayed daily; but this is not mandatory. During the winter months, the window area will be slightly cooler than the inner room area and consequently, the environment of the plants will be cooler, particularly at night. Therefore, care should be taken to prevent the plants from becoming chilled on severely cold nights. Most home growers have found that their plants benefit tremendously by being placed out of doors from May to September. They can be staged under trees or actually hung in the trees. Here the orchids should receive some direct morning and evening sun; but should be in filtered light during the rest



COURTESY JOHN J. NIES

of the day. Out of doors, orchid plants require considerably more water and, especially at this time, they should not be neglected.

Some Cattleya species and hybrids have proven themselves more suitable for home culture than others. *Cattleya mossiae* and its hybrids as well as the many beautiful Brasso-Cattleya hybrids are good home culture subjects.

THE CYPRIPEDIUMS

All of the Lady Slipper-type orchids belong to the Cypripedium group which contains only one extensively cultivated genus, the Paphiopedilums, epiphytic orchids native to Asia. The genus Cyprepedium may be familiar as a wild flower, since these Lady Slippers are terrestrial plants indigenous to North America. They are extremely hard to cultivate and are never grown in the greenhouse or home. Another genus in this group, Selenopedium, has never been successfully cultivated. The Paphiopedilums, then, are the Cypripediums of cultivation and horticulturists refer to them as such, or more frequently, by the affectionate abbreviation, "Cyps." This name will be used here in place of the proper botanical name.

Temperature: The Cyps are divided into two main groups according to their temperature requirements. The "warm" Cyps, distinguished by their mottled leaves, grow best at day temperatures from 75° to 80° and night temperatures of about 60°. The "cool" Cyps, with plain green leaves, require day temperatures from 70° to 75° and night temperatures from 50° to 55°. The warm varieties can be grown with Cattleyas, while the cool ones grow well with other cool orchids. However, both types can be grown together successfully, providing that the night temperature is carefully regulated at 55° to 58°.

Light: Cyps require considerably less light than Cattleyas; 2000 F.C. or about 20 percent of out-of-door summer light intensity is about optimum. As with Cattleyas, the color and texture of Cyp leaves are good indicators of whether or not the plant is receiving the proper intensity of light. A well-grown Cyp should have deep green, rigid leaves free from the surface wrinkles that would indicate tissue dessication.

Slight shading of greenhouse glass is necessary from mid-February to May and in the fall season. Heavier shading will be required during the summer months and none at all during the coldest months of winter.

Watering: With respect to watering needs, the Cyps differ from most of the other cultivated orchids in two ways: they lack pseudobulbs or any other water-storing organs and they have continuous growth. These characteristics dictate that the potting medium of Cyps should never become completely dry. No precise pot-watering schedule for these plants can be given; although, most growers give them a good soaking three times a week during the warm months and

two times a week during the winter months. Overhead sprinkling of plant leaves and greenhouse walks on sunny days is always beneficial and should be done several times a day during the hot weather. Care should always be taken that water does not remain in the new growths for extended periods of time for new tissue can rot quickly.

Ventilation: A damp stagnant atmosphere will quickly arrest the development of Cyp flower buds and prevent their opening. Since these orchids thrive in a fresh invigorating atmosphere every effort should be made to maintain adequate ventilation throughout the year.

Potting: Soon after flowering, Cyps should be repotted and divided, if necessary, in the manner described for Cattleyas. The plant should be inserted about one-half inch below the surface of the potting medium. If it is set higher it will dessicate and if lower it will usually rot. Cyps also prefer small pots; too large a pot can induce waterlogging and root rot. Newly potted plants should not be pot-watered until a new root system has been established. Until that time overhead sprinkling of leaves several times a day will prevent dessication of the plants.

Garden and Home Culture: Many growers place their plants out of doors during the summer where they are grown in lath houses or under shade trees. Cyps will grow vigorously under these conditions, providing sufficient shade and water are supplied.

"Warm" Cyps make excellent home culture subjects and can be treated like almost any house plant. They should be placed over a gravel tray and kept moderately moist in an east window. In air conditioned homes both cool and warm Cyps seem to grow well. Many excellent specimen plants have been grown by home orchid enthusiasts.

THE CYMBIDIUMS

Cymbidiums are Asian orchids, indigenous to high elevations of the Himalayan and Khasia Mountains. The beautiful flowers of these orchids are carried on long arching sprays and their delicate colors, heavy waxy substance, and good keeping qualities have made them favorites with orchid growers everywhere.

More frequently than not, Cymbidiums are the stepchildren of the average orchid collection. Horticulturists know less about the environmental factors which influence their growth and flowering than they do about any other major group of orchids. Although the general requirements for Cymbidium culture have been established, the Cymbidium grower should be warned that many plants simply do not conform to any recognized flowering pattern and will persistently defy all efforts to induce flowering.

Temperature: Cool nights and mild days typify the mountain regions where Cymbidiums grow. Ideal day temperatures in the greenhouse should

be 70° to 75° and night temperatures 50° to 55°. Summer temperatures in many areas will average considerably higher than this but the heat will not appreciably restrict growth and development providing all other environmental factors are maintained near optimum. Temperatures which fluctuate rapidly are undesirable, especially during the growing period for they can inhibit growth in some Cymbidium clones. Bud initiation normally occurs from August 15 to January 1. During this period cooler temperatures, preferably below 55° at night and under 75° during the day are necessary for flower bud initiation in many Cymbidium species and their hybrids.

Light: Cymbidiums require higher light intensities than Cattleyas, with 4000 F.C. of light being optimum for most varieties. Shading would therefore be lighter than for Cattleyas. High light intensities seem to be necessary, not only for good vegetative development, but also to promote flower bud initiation.

Watering: Cymbidium potting medium should never be allowed to approach the point of drying out. Plants potted in a well-drained compost can be flooded three times a week during the winter months; and, during the hot summer, daily pot-watering is not excessive. Restricted watering or severe drying of the potting medium during the growing season will usually stunt the developing growths and retard flowering.

Ventilation: Abundant fresh air is essential to good Cymbidium culture. It is especially important to admit fresh air during the winter months to avoid a stale atmosphere while flower buds are developing.

Feeding: Cymbidiums are heavy feeders and most growers apply mild applications of organic or commercial fertilizers every two weeks during the growing season, from March through October.

Potting: Potting of Cymbidiums should be done immediately after flowering. At this time new growths are developing and the plants will have several months of cool weather in which to establish vigorous root systems before unfavorable summer conditions arrive. Cymbidiums do not like to be repotted, neither do they like small containers. It is advisable, therefore, to pot all mature plants in pots large enough to accommodate two or even three years of growth.

Many types of potting mixtures have been used successfully in Cymbidium culture; until now there have been as many Cymbidium potting mixtures developed as there are Cymbidium growers. Throughout the Middle West, most growers are now using fir bark. Frequently a little sand, about one-eighth the total volume is added to the fir bark. The potting techniques described for Cattleyas apply also to Cymbidiums. After being repotted, plants should have reduced light and limited water (enough to prevent drying of medium), until a new root system has been established.

Garden and Home Culture: Year-round garden culture of Cymbidiums is possible in areas where the nights are cool enough for bud initiation yet where the temperature does not fall

below 28°. Both pot culture and open bed plantings are possible in such areas. Where winters are colder, Cymbidiums can be placed out of doors from May through September. A lath house is an excellent outdoor growing structure for Cymbidiums, but, in lieu of a lath house, a good shade tree can be employed to shelter the plants in the cool, open air during the hot summer.

Cymbidiums cannot be recommended for home culture. Light, temperature, and humidity requirements are below optimum in the home and the plants quickly deteriorate.

THE ODONTOGLOSSUMS

The Odontoglossum group inhabits the tropical areas of the Western Hemisphere from Florida south to Argentina and is found growing from sea level to 12,000 ft. elevations. This group is the largest and most interesting one in the Orchid family. The flowers exhibit almost incredible variations which have made these fascinating orchids the favorites of many amateur orchid growers. The three most important cultivated genera in this group are the Oncidiums, the Miltonias and the Odontoglossums. Also many beautiful inter-generic hybrids have been made, particularly by European growers, who are the leaders in Odontoglossum hybridizing.

ONCIDIUM

Oncidiums grow well if potted in fir bark, although many species are natural creepers and horticulturists find that they do best when wired to a slab of tree-fern (Ciborium sp.) or allowed to grow up a tree-fern pole which is placed in the pot. Light, water, aeration and fertilizer requirements for most Oncidiums are similar to those stated for Cattleyas. The "warm" and "intermediate" Oncidiums grow and flower well at Cattleya temperatures; but the "cool" or high altitude members of this genus prefer night temperatures near 50° and day temperatures from 60° to 70°. The warm and intermediate Oncidiums will grow well out of doors in the summer if placed in a lath house or hung under a shade tree. A few growers have been successful in growing Oncidiums in the home, where

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Oncidium Burgeffianum growing on a tree-fern raft.

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Oncidium varicosum growing on a tree-fern pole.

they are usually cultivated like Cattleyas.

MILTONIA

The Miltonias, frequently called the "pansy orchids," are moderately cool growing Orchids. They grow well at the temperatures prescribed for Cymbidiums and under the light intensities prescribed for Cyps. Miltonias deteriorate rapidly in extreme heat; and, consequently, they are difficult subjects for areas with hot summers. They require copious watering during their vegetative period; but a damp stagnant atmosphere should be avoided for it encourages leaf spotting diseases which are common to Miltonias. Like the Cyps, the Miltonias prefer small pots. They should be repotted after flowering, using the methods and materials described for Cattleya potting. Miltonias will grow well in a shady and cool garden spot during the summer. They cannot, because of temperature requirements, be recommended for home culture.

ODONTOGLOSSUM

Most of the Odontoglossums are indigenous to high elevations in the Andes mountains, where they are found growing at altitudes from 8000 to 12,000 ft. These plants are extremely difficult to grow in any area where hot summer conditions prevail. They require night temperatures of 45° to 50° and day temperatures from 60° to 70°. "Odonts," like Miltonias, deteriorate rapidly under hot summer conditions; such innovations as evaporative coolers have made it possible to grow these lovely orchids in areas where previously they could not be grown. A few species of Odontoglossum (*Odontoglossum grande* and O. *citrosmum*) grow at low altitudes and these plants can be successfully cultivated with Cattleyas. Odonts require 2000 F.C. of light, about the same intensities as described for Cyps. The warm species should be watered like Cattleyas but the cool types require considerably more water and should never be allowed to become completely dry. Odonts require a moist atmosphere with an abundance of moving air.

Potting should be done immediately after flowering, providing that is not just preceding or during the warm season, in which case fall potting is recommended. Potting procedure is identical to that prescribed for Miltonias. Odonts belonging to the warm class adapt themselves readily to garden culture; but very few growers have successfully grown these plants in the home.

THE DENDROBIUMS

The Dendrobiums are in many respects the Asian counterpart of the American Odontoglossums, for there are over 1000 described species which are all extremely variable. Culturally, the Dendrobiums are divided into two groups—the evergreen types and the deciduous types. Each of these inhabits a specific geographic area and, consequently, has its own cultural requirements.

EVERGREEN DENDROBIUMS

As indicated by the name, the evergreen Dends retain their leaves and require no definite resting period. They require a night temperature of 60° and day temperatures above 70°. These orchids need high light intensities, almost daily waterings and bimonthly fertilizing during the growing season. They are very easy to grow and they produce an abundance of flowers. In the garden these Dends should be placed in a bright location and moved indoors before cool weather begins. Evergreen Dends will usually make excellent vegetative development under home culture; but the flowers are easily damaged by a dry, stagnant or gas-polluted atmosphere and as a result frequently fail to flower in the average home.

DECIDUOUS DENDROBIUMS

The deciduous Dends are grown precisely like their evergreen cousins when in vegetative growth. In late November or early December, however, they should be "rested" by lowering the night temperature to 50°. A cool corner of a Cattleya greenhouse where the temperature may go as low as 55° at night will suffice as a resting place. Watering should also be restricted and plants should only be soaked (pot-watered) once every two weeks. Such treatment will encourage flower bud development. As soon as the flower buds appear opposite the leaves on the previous year's growth, normal watering can be resumed and temperatures can be increased. While resting is not mandatory for flower bud development, it does encourage simultaneous development of all flower primordia which results in spectacular mass blooming. The deciduous Dends grow well in the garden during the summer months; but they prefer a more shaded location than the evergreen types. Home culture of these plants has not been too successful, principally because the cool requirements of the "resting" period cannot be satisfied.

Dendrobiums should be potted soon after flowering and just as the new growths begin to develop. They prefer small pots and grow well in fir bark. Many Dendrobiums can be propagated from vegetative "offshoots" which develop from buds located at the leaf nodes. When they are about three inches long these little plants can be removed and potted in small pots. They develop rapidly and usually flower in about two years.

THE VANDAS

Two important cultivated genera compose the Vanda group—Phalaenopsis and Vanda. Both are native to tropical Asia and are found in hot, humid climates.

PHALAENOPSIS

Phalaenopsis orchids require warm night temperatures no lower than 60°. Many growers raise night temperatures to 65° or 70° during the period of vegetative growth, from March to September. Day temperatures should be 75° or above. Drafts and rapid temperature fluctuations should always be avoided.

The light intensities prescribed for Cyps are equally applicable to Phalaenopsis. During the summer the light should be reduced to about 20 per cent of natural intensities. Less sheltering from light will be necessary during the Spring and Fall and none during the period from November through January.

Phalaenopsis, like the Cyps, have no water-storage organs and, consequently, should never be allowed to dry out. Plants can be pot-watered daily during the summer growing period and less frequently during the rest of the year. The atmosphere should be kept humid by periodically wetting down the walks and plant leaves, but this should be done early enough to permit leaves to be dry by nightfall for these orchids are very susceptible to leaf and crown rot. Phalaenopsis are heavy feeders and most growers fertilize with a water-soluble chemical fertilizer once every two weeks.

Air movement is very essential for good Phalaenopsis culture. A humid atmosphere without moving air, encourages pathogenic and insect diseases.

Phalaenopsis are best repotted after flowering. Large pots or pans which can be filled almost half full of broken pots or gravel should be used. Newly potted plants should not be thoroughly pot-watered until a strong new root system has developed.

Garden culture of Phalaenopsis during the summer months is possible, providing the plants are in a good shady location and receive sufficient water and fertilizer. Generally, home culture has not been possible with these plants, since the average home atmosphere is much too dry.

VANDA

Vandas will grow well with intermediate orchids if they are located in a warm sunny location in the greenhouse. Their temperature requirements are the same as those stated for Phalaenopsis; but they need high light intensities, as much as fifty per cent of outside light during the summer. An unshaded greenhouse during the winter months is necessary for good growth and flowering of Vandas.

Daily pot-waterings during the summer months are not excessive, although a more restricted watering schedule should be followed during the winter months. Vandas like a humid atmosphere and frequent wetting of walks and plant leaves, especially on sunny days will stimulate growth and flowering. In addition,

Vandas are heavy feeders and a bi-monthly feeding with animal or commercial fertilizers is desirable.

A well-aërated potting medium, which drains rapidly, is necessary for good Vanda culture. Many Vandas are grown in open wooden baskets. If fir bark is used for a potting medium, the large "chunk" grade is best since it will give adequate aëration and drainage. These orchids require large potting containers. As with other orchids, newly potted plants should be watered sparingly until a new root system is established.

Garden and Home Culture. A good sunny location is desirable for summer garden culture of Vandas; some growers acclimate their plants to full sunlight. However, most growers prefer some form of shading for outdoor culture. Vandas do not grow well in the home since light and humidity are usually inadequate.

BOTANICAL ORCHIDS

Sooner or later every orchid grower hears the name "Botanical" given some of the cultivated orchids. This term is applied to any orchid species or hybrid which is purely a collector's item and which has no general commercial or exhibition value. The number of these collector's items available to the botanical enthusiast is almost limitless, as most of the species in the Orchid family can be classified as Botanicals. Botanical orchids were very popular during the 19th Century and horticulturists considered them most desirable subjects for the orchid collection. During this period many fine botanicals were cultured in England and the United States. The early 20th century brought an expanding orchid cut-flower market as well as improved methods of orchid seeding culture which resulted in a tremendous emphasis in hybridization of commercial and exhibition type orchids. Today a rebirth of interest is developing in the long-neglected botanicals. Many orchid collectors are growing botanicals exclusively and others are realizing that some botanical orchids have flowers that are more distinctive and equally as charming as the flowers of the large, showy exhibition hybrids. The Missouri Botanical Garden has one of the oldest and most comprehensive botanical orchid collections in the Western Hemisphere. This collection is constantly being expanded and orchid collectors who are interested in botanicals will always find a number of these plants (collector's items) in flower at the Garden.

ORCHID DISEASES

Orchid diseases can be divided into three categories: environmental, pathogenic and insect diseases. Environmental diseases are caused by poor growing conditions where one or more environmental factor is not optimum. These deviations result in unhealthy and poorly grown plants. Pathogenic diseases are caused by the invasion of bacteria, fungi, or viruses into plant tissues; while insect diseases result from attacks by insects. Orchids are

unusually hardy and remarkably free of the many diseases which attack most cultivated plants. Nevertheless, severe damage can quickly occur and recovery is frequently a lengthy process.

ENVIRONMENTAL DISEASES

An environmental disease may be thought of as a two-edged sword, for it not only weakens and retards the plant but it also opens avenues through which insects and pathogens can attack.

Temperature

Temperature regulates the rate at which plant physiological processes proceed and each orchid type has its own optimum day and night temperature requirements for each of the various phases of growth, flowering and fruiting. A 15- to 20-degree variation between day and night temperatures is usually normal for most orchids. Plants grown at below optimum temperatures are physiologically retarded and make weak, small growths. At temperatures above optimum, many orchids will not initiate flower buds, and they use up food (respire) faster than they can replace it. At extremely high temperatures, all photosynthesis (food making) stops, tissue burning may occur and even death result. Every effort should be made to keep plants cool during hot periods. Proper shading, aëration, watering and humidity are essential. Orchid flowers are also sensitive to heat and will keep longer in a cool environment.

Light

Intensity: While optimum light intensities have been stated for the various major orchid groups, it must be remembered that the amount of light any individual plant can efficiently use is relative and dependent upon the general condition of the plant as well as other factors in the plant's environment. To illustrate: a Cattleya, growing in a decomposed potting medium, with a weak, under-developed root system, cannot possibly withstand 4000 F.C. of light and leaf bleaching or burning will occur. In contrast, a sister plant, in a fresh potting medium with a vigorous root system, will grow and flower profusely when receiving 4000 F.C. of light. Caution should always be exercised in moving plants from areas of low intensity into areas of high light intensity, for bleaching or burning of leaf chloroplasts may occur. Plants should always be gradually exposed to higher light intensities.

Quality. Intensity is not the only characteristic of light which can develop environmental disturbances in plants. Orchids should be grown under light which approximates, as closely as possible, the wave-lengths of natural light. Colored plastics and greenhouse shadings should be avoided, since photosynthesis can be severely restricted if certain essential light wave-lengths are reduced or absent.

Duration: An abnormal day length can have an adverse effect on flowering. Some orchids have flowering cycles which are so sensitive to day length that flowering will be irregular or completely inhibited by abnormal day lengths such as would be found in homes where lights are on every eve-

ning thus extending the photoperiod (day length).

Air Pollution

Orchid plants and flowers are particularly susceptible to polluted air. A small amount of illuminating gas in the air will quickly kill orchid blooms and can even cause plant defoliation and death. Industrial gases in the air can also affect orchid plants and flowers. Sepal wilt of Cattleya flowers is caused by polluted air and is frequently encountered in large cities and in industrial areas.

PATHOGENIC DISEASES

Bacterial, fungal and virus diseases do not usually attack orchid plants. Since these organisms, carried chiefly by man and insects, thrive in a damp, cool, stagnant atmosphere, they frequently infect plants growing in such areas. Bacteria and fungi usually appear as black or brown spots or as irregular black or brown areas beneath which the tissue has decayed (necrotic areas). Some of the fungus diseases spread rapidly through succulent plant tissues and a plant can be killed within several days. At the first appearance of any of these symptoms, the infected tissues should be removed by surgery. Greenhouse humidity should be lowered, overhead sprinkling of leaves suspended and infected plants watered sparingly. If possible, infected plants should be isolated. If this procedure does not check the infestation, spraying with a commercial fungicide may be necessary.

Virus diseases are a special problem, since they are systemic and consequently affect the entire plant. Furthermore, any division separated from an infected plant will also be infected. A plant can not be cured of virus. Virus diseases usually appear as irregular light-colored fleckings or streakings which may later turn black. The general vigor of the plant is usually affected and new growths may be retarded. Viruses can be transmitted easily by man and insects, therefore infected plants should be isolated or destroyed.

INSECTS AND OTHER PESTS

Orchids are subject to attack by several insects, the most common of which is orchid scale or Boisduval's scale (*Diaspis Boisduvalli*). This insect will attack any part of an orchid plant. It usually collects in irregular fluffy white colonies which are frequently found under the dry pseudobulb sheaths where they cannot be seen or easily killed by conventional spray methods. Keeping the sheaths removed will prevent heavy infestations of scale insect. DDT, Malathion, or Parathion are all very effective against orchid scale. This insect can easily build up resistance to one or more of

A heavy infestation of orchid scale on the pseudobulbs and stems of a Cattleya hybrid.

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these sprays, therefore it is not advisable to use any one of them exclusively.

Thrips (*Euthrips orchidii*) is another insect which preys on orchids. It feeds on tender young growths by rasping away the epidermal tissue and sucking the plant juices. This insect is extremely minute, averageing $\frac{1}{32}$ to $\frac{1}{16}$ of an inch in length. Thrips move very rapidly and many growers are completely ignorant of their presence. Like scale, thrips can be exterminated with DDT, Malathion or Parathion.

Red Spider (*Tetranychus bimaculatus*) is a frequent pest on orchids. This small red mite lives on the underside of leaves where it sucks plant juices and produces a characteristic small white speckling on the underside of the leaf. This is one of the most difficult pests to eradicate for it is difficult to detect, it multiplies rapidly and it frequently develops strains which are resistant to specific poisons. Numerous commercial pesticides are on the market which are especially designed to kill Red Spider.

Slugs, Cockroaches, Sow Bugs and Springtails are scavengers which are frequently encountered in the greenhouse. These animals are usually nocturnal and live on decaying vegetable material but they also attack orchid flowers and succulent vegetative growths. Slugs can be controlled through the use of poison baits or by spraying or dusting with commercial slug-killing preparations. Cockroaches, Springtails and Sow Bugs are all easily controlled with chlordane sprays or dusts.

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ORCHID CULTURE CHART

Genus	Light Summer* (foot candles)	Temperature Day (degrees F.)	Temperature Night (degrees F.)	Watering** Summer	Watering** Winter	Fertilizing Summer	Fertilizing Winter	When To Pot***	House Plants	Summer Garden
Cattleya	3000	70–85	60	3	2	Monthly	None	On new roots	Rec.	Rec.
Warm Cyps	2000	70–80	55–60	Daily	3	Monthly	None	After Flower.	Rec.	Rec.
Cool Cyps	2000	70–75	50–55	Daily	3	Monthly	None	After Flower.		
Cymbidium	4000	70–75	50–55	Daily	3	Bi-Month.	None	After Flower.		Rec.
Oncidium	2–3000	60–75	50–60	3	2	Monthly	None	On new growth	Rec.	Rec.
Miltonia	2000	70–75	50–55	3	3	Monthly	None	After Flower.		Rec.
Odontoglossum	2000	60–75	45–69	Daily	3	Monthly	None	After Flower.		Rec.
Evergreen Dends	4000	70–85	60	Daily	3	Bi-Month.	None	On new growth		Rec.
Deciduous Dends	3000	70–85	50–60	Daily	3	Monthly	None	After Flower		Rec.
Phalaenopsis	2000	75	60–65	Daily	3	Bi-Month.	Monthly	After Flower		Rec.
Vanda	4000	75	60–65	Daily	3	Bi-Month.	Monthly	Anytime not flowering		Rec.

* No shading is necessary during the winter months.

** Number indicates times per week.

*** Fir bark is recommended as the most practical potting medium.

Rec. Abbreviation for recommend.

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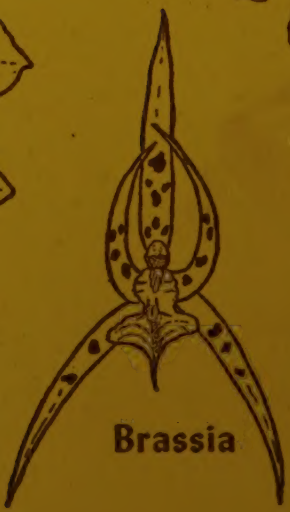
Cymbidium

Phaius

Miltonia

Dendrobium



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